

**Supply Chain Management**  
**Course Number: 22:799:638**  
**Course Title: Healthcare Analytics**

## **COURSE OVERVIEW**

With the shift to value-based care, the healthcare industry is placing increasing emphasis on creating value for patients while increasing performance targets for care providers. Healthcare analytics and its application, therefore, play a critical role in assisting care providers to examine their internal processes and operations, and to propose new ways for them to create value efficiently and effectively. Healthcare analytics is the branch of analysis that focuses on offering insights into health system management based on data collected from four areas: claims and cost data, pharmaceutical and research and development (R&D) data, clinical data, and patient behavioral and sentimental data. The area of healthcare analytics is growing quickly and is expected to reach more than \$18.7 billion by 2020.

This course reviews data sources, data processing, and data analytics models and tools with a focus on care provider performance in cost efficiency, revenue, process, clinical outcomes, and patient experience. Upon completing the course, students should be able to perform business analysis in the above areas. The new course will greatly improve the relevance of healthcare analytics curriculum and also allow students to get hands-on, guided practice from analytics professionals in the healthcare industry.

---

## **COURSE MATERIALS**

### **Textbook**

Two *Course-pack* is required for the course, which includes required cases and reading materials. Instructions and ordering information will be announced in Week 1 of the semester.

**Required Case I on Analyzing Low Patient Satisfaction at Herzog Memorial Hospital** by Harvard Business Publishing: (You might already had this case purchased through prior OA class or existing class, you don't have to purchase this again if prior purchase was made).

**Required Case II on University Hospital: The Joint EP/CATH Lab Decision** by Harvard Business Publishing:

Suggested e-Textbooks free download from Rutgers Library:

*Analytics in Healthcare: A Practical Introduction*, Christo El Morr, Hossam, Ali-Hassan. ISBN 2193-1712 (Electronic).

*Tableau Your Data*, Daniel G. Murray, Wiley, ISBN: 978-1-118-83946-1 (ebk)

### **Software**

In this course, we will use *Microsoft Excel & ACCESS/SQL* to prep data. In addition, we will need to use Tableau to visualize data and additional program languages to conduct further statistical analyses. While no specific program languages are required, you should have basic programming skills with one of the following software packages R, Python, SAS, or STATA. Tableau licenses can be requested directly from the company and other statistics software licenses should be secured by students themselves.

---

## **COURSE OBJECTIVES**

The objective of the course is to introduce data-driven models, skills and tools so that students can learn how to analyze and interpret data collected from multiple sources to assess performance baselines and to identify areas for improvements. Specific objectives include

- Attain a strong foundational understanding of value-based care and the new payment models used by health systems and accountable care organizations
  - Understand challenges associated with value-based care reimbursement systems
  - Understand common data and structures that are available within healthcare settings
  - Apply database management skills to extract, screen, and combine data from different sources
  - Apply quantitative models and programming skills to visualize data, analyze data, and interpret results
- 

## **PREREQUISITES**

22:544:575: Data Analytics and Decision Making and/or 22:799:580 Operations Analysis

---

## **ACADEMIC INTEGRITY**

*I do NOT tolerate cheating.* Students are responsible for understanding the RU Academic Integrity Policy (<http://academicintegrity.rutgers.edu/>)

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, “On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment.” I will screen all written assignments through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large database of past work. Don’t let cheating destroy your hard-earned opportunity to learn. See [business.rutgers.edu/ai](http://business.rutgers.edu/ai) for more details.

---

## **COURSE RELATIONSHIP WITH OTHERS IN THE PROGRAM**

This course complements other courses in the MS-HSM program because it provides quantitative models and tools to improve operational and tactic issues in healthcare setting, such as cost efficiency, waiting time, health IT, process performance, patient experience, and resource planning.

**Two Most Closely Related Courses and description of the differences from the proposed course:**

**22:799:580 Operations Analysis (3 credits)**

This is the core MBA course that discusses general operations and supply chain management issues in manufacturing and distribution industries.

**22:799:696 Healthcare Services Management (3 credits)**

This course provides students with strategies, techniques, and best practices to improve unit, organizational, and integrated delivery system performance by applying key concepts from operations and supply chain management to the healthcare context. The Operations Analysis course complements this course by introducing quantitative models and tools to address operational and tactic issues that can be applied to healthcare delivery systems.

---

**LEARNING OUTCOMES**

- Understanding different performance metrics of a healthcare service provider under the value-based care model
  - Understand the contexts associated with different primary and secondary data pertaining to care providers in healthcare settings
  - Review basic commands in EXCEL
  - Learn to extract, screen, and build databases through SQL
  - Apply Tableau to visualize data with dashboards
  - Apply certain program (R, Python, SAS, or STATA, etc.) to address managerial questions by using regression models, logit models, cluster analysis, time series models.
- 

**PROJECT**

The class includes four projects. The first project focuses on individual work on data analysis. The second project is team-based and involves data manipulation, analysis, and presentation of results with visualization through Tableau. Projects 3 & 4 will be based on the two HBP cases and supplement data. Each team consists of 2-3 contributing students. Project work will be evaluated based on the interpretation of the data structure, the correctness and thoroughness of the data analysis, and visual demonstration of the results. Every team member must contribute to the project and participate in final presentation (detailed requirements for the project are noted below). **Each team member must specify his/her percentage of contribution on the final submitted work. The project will be graded as a whole but each team member's grade also depends on his/her contribution.**

**Note:** You should *not* cut-and-paste verbatim material from Web pages or copy verbatim material from any other sources, unless you use that material as exact quotes. In that case be sure to enclose any pasted text material in double quotes and to provide an exact reference for it! All pasted graphs and charts should also be properly referenced. If you are unsure about referencing materials, please see the Academic Integrity information on Canvas and/or the [Academic Integrity at Rutgers webpage](#).

---

## TEACHING METHOD

The course will be taught using PowerPoint presentations, case studies, and hands-on exercises. In each week, we will complete one lecture and all the associated readings, case studies, exercises and homework (see attached weekly schedule). Class-related material (lecture notes, videos, homework and solutions, etc.) will be posted on Canvas. Students should be enrolled in Canvas to access the posted materials. The URL is: <http://canvas.rutgers.edu>.

---

## GRADING

The class include four projects and presentations. The weights for course work components are given below.

Class participation	20%
Project1	15%
Project2	25%
Project3	15%
Project4	25%
<b>TOTAL:</b>	100%

---

## COURSE SCHEDULE

### 1. Data Analytics Overview

Topic	Objectives
Different analytical models	General regression, time series, logistics regression, association rule, multivariate analysis, simulation
Outcomes	Understand different model setups, analysis process, statistical inferences

## 2. Data Analytics Overview

Topic	Objectives
Different data sources and governance	Learn different data sources from clinical outcomes, cost, process, quality, and resources
Hands-on session	Testing various models with sample data, R, Tableau

## 3. The shift from Volume to Value

Topic	Objectives
History of Healthcare Payment Models	Provide students a background on the industries previous attempts to move to value
Who is the customer?	Challenge students with an interactive discussion around accountability to help them understand the complexity of unaccountable vs accountable purchasing and decision-making in healthcare
Consumerization and Pricing Transparency	Go through topical articles about recent legislation to improve pricing transparency and minimize information blocking in healthcare.

## 4. Translating the concept of Population Health into a Business Model

Topic	Objectives
The Cost Curve	Introduce students to the ultimate KPI for population health and how we use it at the macro level to gauge the performance of the US healthcare system but also how we are trying to arbitrage with it at the local level.
Contracting Models	Introduce the different types of value-based arrangements helping students understand the key advantages around profitability, managing risk and hedging utilization trends.
The Value-Equation in Population Health	Step students through how an ACO makes money in a value-based arrangement including the typical

	algebra as well as a deep dive into all the levers available to an ACO.
Pop Health Analytics Staffing Models	Introduce a staffing model to support value-based contract performance with a high-functioning actuarial and clinical informatics teams including responsibilities, typical backgrounds, goals and team dynamics.
Physician Incentives	Introduce students to various physician incentive scenarios now used in the industry to improve performance.

#### 5. Defining "Sick", project #1 available

Topic	Objectives
Understanding Risk Adjustment	Provide a deep understanding of the various approaches to risk adjustment, including pros/cons, calculation methods and examples of how important RAF is to contract performance.
Risk-Adjustment Analytics	Step students through several use cases where data science and analytics will differentiate and maximize risk-adjustment returns. Define metrics to measure the operational quality of clinical documentation.
Present Risk-Adjustment Assignment	Work with typical datasets (private and public) to help make providers make data-driven decisions to optimize value.

#### 6. Quality - a critical success factor to any value-based arrangement

Topic	Objectives
Quality Management definitions (ambulatory vs inpatient)	Step students through the vocabulary and methodologies they'll need to understand to successfully develop analytics around ambulatory quality.

High-functioning quality management is all about process fueled by analytics	Provide an in-depth view of the data and analytics needed to describe ambulatory quality, diagnose issues in the clinical processes causing poor quality and leveraging data science to predict and prescribe clinical decision support at the point of care.
Project #1 due	

### 7. Care Management and Social Work Analytics, project #2

Topic	Objectives
The transition from Case to Care Management	Help students understand how changing payment models can free up investments for more holistic care and change what we care about first.
Social Determinants of Health	Explain the value and trends in leveraging SDH data into analytics to build better predictions and improve the efficiency of care delivery as it has in AdTech among other industries.
Social Work at Scale	Students will discuss how analytics can help to prioritize SDH issues and introduce new metrics around productivity, effectiveness and efficiency to scale up
Care Management Models	Students will discuss how analytics can be used to find both the highest risk and the rising risk patients, align them to CM resources and create efficiencies both retrospectively and prospectively.
Post-Acute Care	Students will learn how this often excluded place of service is one of the most loosely managed, highest risk and most expensive drives of care. Students will discuss analytics that can help identify the good and bad actors and what can be done to improve post acute care.

### 8. IoT, Remote Patient Monitoring and other Consumer-First Trends in Healthcare

Topic	Objectives
-------	------------

Connected Device Strategy	Students will discuss how IoT is changing industries and how this can be capitalized on for healthcare. Students will be introduced to initiatives and get a chance to debate the efficacy.
RPM infrastructure design	Enabling analytics isn't the first priority but it should be and we'll debate approaches to designing an analytics-friendly architecture for RPM at scale.
Consumer Digital - changing expectations	Discuss trends in consumer-friendly experiences in healthcare from telehealth, online booking, digital check-in
Data Privacy and Data Sharing	Describe the evolution and expectations around digital data privacy and the challenges it presents as data sharing becomes faster and easier. Students will be encouraged to debate this conflict and identify ways for analytics to help both.

### 9. Analytics to Optimize Utilization

Topic	Objectives
What utilization is controllable?	Step through examples of utilization management initiatives that are likely to be reasonable and effective
Analytics to explain and prioritize utilization	Utilization opportunities are vast, but most have very limited ROI. Students will practice using analytics to quantify the opportunities, evaluate the likelihood of success and make data-driven recommendations.
Analytics and data science to optimize utilization	Students will be introduced to advanced analytics that can improve contract performance such as network optimization, event prediction and behavioral economics/influence.
Project #2 due	

### 10. Analytics to Improve Patient Experience, project #3 available

Topic	Objectives



How patient experience is measured?	Step through different measurement of patient experience to understand the multivariate nature of patient experience
Identify areas for improvement and root causes for experience related issues.	Using analytical tools to visualize and compare patient experience across different patient groups, identify common trend as well as other contextual related factors that might help explain variation in the data
Predictive capabilities	Use a simplified multivariate method to develop a causal model to capture what factors are most important to drive overall patient satisfaction

### 11. Analytics to Improve Patient Experience

Topic	Objectives
Data analysis and discussion	Developing a causal model and test the model's predictive capabilities.
Project #3 due	

### 12. Analytics for Scheduling/Capacity Planning, project #4 available

Topic	Objectives
Scheduling/capacity planning	Schedule capacity to maximize utilization and reduce costs
Optimization/simulation	General introduction to simulation. Based on a discrete simulation package, derive capacity utilization rates, compare various scenarios and
	select the best planning setup to maximize utilization and minimize costs. Visualize the results and communicate the results in meaningful ways.

### 13. TBD

Topic	Objectives

TBD	Continue with wk12 or guest speaker session, depending on progresses made by the class
-----	--

#### 14. Team Presentation

Topic	Objectives
Project #4 due	

---

### SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at [ods.rutgers.edu](http://ods.rutgers.edu).

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email [dsoffice@echo.rutgers.edu](mailto:dsoffice@echo.rutgers.edu)]

[Rutgers University-Newark ODS phone (973)353-5375 or email [ods@newark.rutgers.edu](mailto:ods@newark.rutgers.edu)]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email [jackie.moran@rutgers.edu](mailto:jackie.moran@rutgers.edu)]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email [TitleIX@newark.rutgers.edu](mailto:TitleIX@newark.rutgers.edu)]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email [deanofstudents@echo.rutgers.edu](mailto:deanofstudents@echo.rutgers.edu)]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email [DeanofStudents@newark.rutgers.edu](mailto:DeanofStudents@newark.rutgers.edu)]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: [https://cm.maxient.com/reportingform.php?RutgersUniv&layout\\_id=7](https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7) . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at [TitleIX@newark.rutgers.edu](mailto:TitleIX@newark.rutgers.edu). If you wish to speak with a staff member who is confidential and does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email [run.vpva@rutgers.edu](mailto:run.vpva@rutgers.edu)]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu> .

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of *mental health* services, please use our readily available services.

[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]

[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of *physical health* services, please use our readily available services.

[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]

[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of *legal* services, please use our readily available services: <http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to *English as a second language (ESL)* should contact the Program in American Language Studies for supports.

[Rutgers–Newark: [PALS@newark.rutgers.edu](mailto:PALS@newark.rutgers.edu)]

[Rutgers–New Brunswick: [eslpals@english.rutgers.edu](mailto:eslpals@english.rutgers.edu)]

If you are in need of additional *academic assistance*, please use our readily available services.

[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>]

[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]

[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.

- Students must sign, date, and return a statement declaring that they understand this syllabus.]